

Journal

- Williams New Playfield Coating 4
- Sega *Enduro Racer* Steering Stop 4
- Williams Flipper Power Solenoid Coils 5
- Rowe *CD-100* Mech Scratched CDs 5
- Sanyo Monitor Black Vertical Lines 5
- Williams Introduces New Pinball Technology 6
- MicroProse *F-15 Strike Eagle* Connections 9
- So, What'd Ya Like At The *ACME* Show? 10
- Williams *Funhouse* Plunger Switch 12
- Rowe *CD-100* And *CD-51* Random Play 12
- Bally & Stern Pinball Tester Review 14
- Rowe's *OBA-2 Bill Transport* Repair & Maintenance (Part 1) 18
- *MarketPlace* 22



THE RIGHT STUFF !



STAR★TECH Journal's ADVANCED TROUBLESHOOTING Service Manual



ADVANCED TROUBLESHOOTING

For The Servicing And Maintenance
Of Coin-Operated Amusement Machines



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Section III Power Supplies Linear/Switching Comparison Chart, Linear Supplies, Fixed Terminal Regulator, Series Pass Regulator, Failure Modes, Crowbar Circuit, Modifications, Switching Supplies, Pulse Width Modulation, Common Mistakes, Troubleshooting Checklist.

Section IV Monitors Common Errors, Rules of Thumb, Wells Gardner K7000, Common Problems, Hantarex MTC9000, Common Problems, RGB Generator.

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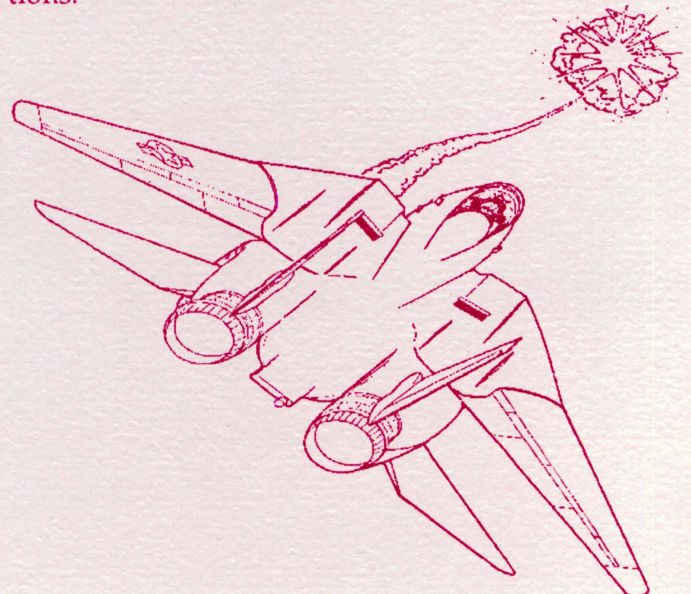
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Sega *Enduro Racer* Steering Stop

G.L. (Moose) Foster
Glenn Jones, Inc.
Kemmerer, Wyoming

Ken Lee
Ace Coin
Evanston, Wyoming

PROBLEM

We had a Sega *Enduro-Racer* kit installed of which the left turn stop for the handle bars was way off.

If a player made a hard left turn while playing the game he would run past the stop inside the steering pot.

SYMPTOM

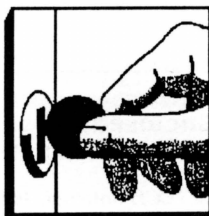
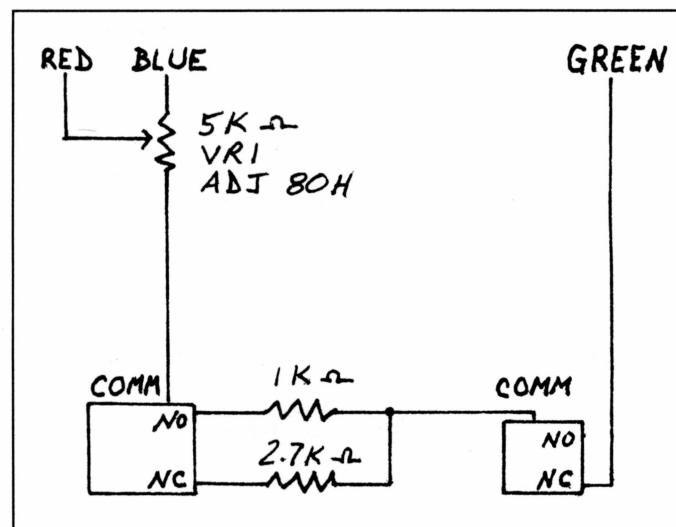
This condition then made the rider of the display turn right. We would have to replace the steering pot every two or three days.

SOLUTION

We saw how we could mount two micro-switches beside the large steering gear which would allow for a degree of steering control.

The following schematic shows how to wire the two switches and still achieve the recommended centering adjustment of 80H.

The only draw back to this configuration is that you either make a hard turn or you don't turn at all. The benefit is less service calls.



Williams Flipper Power Coils

Larry DeMar
Williams Electronics
Chicago, Illinois

OPERATOR FEEDBACK

Funhouse needs flipper help. Trying to make all those clever and interesting shots without any flipper power is depressing. How about a "solid state" flipper?

FACTORY RESPONSE

It is not the technology of the flipper that determines power. It is merely the selection of the proper coil. The 3 different strength coils you have seen on Williams' games are:

Yellow (Weakest)

Green

Red (Strongest)

We also have experimented with a stronger coil (It had a *Blue* label), and while providing higher power, it proceeded to destroy most of the posts and targets on the playfield in a couple of months time.

You will notice that the upper flippers on our games use the *Yellow* and *Green* coils. These provide the necessary power, and don't harm the components that they are situated so near.

CONCLUSION

It may look to you as if we don't pay the attention to our flippers as we do to our fancy shots and mechanisms, but if you examine the bigger picture, you will see that we have balanced things out correctly.



Rowe CD-100 Mech Scratched CDs

Evan Wessel
Mercury Amusement
Havertown, Pennsylvania

PROBLEM

Has anyone else had problems with the Rowe mech scratching the outer 1/2" of the CD? This is a nuisance, when a disk has a lot of songs on it, since this causes the last track to skip. In addition, used record stores will not buy the older disks due to the scratches.

SOLUTION

I talked to my distributor and he informed me that the *Molded CD Magazine & Gripper Bow* kit is available to fix this problem. (It is *not* free, however). Contact your distributor for more information.

Sanyo Monitor Black Lines

Phil Ivany
Regent Vending
Ottawa, Ontario, Canada

SYMPTOM

Black vertical lines on Nintendo (Sanyo) monitor.

SOLUTION

Replace C302. Rating: 1mfd @ 50 volts.

MURPHY'S LAW #1303

Forgive and remember.

Williams Intros New Pinball Technology

Williams Electronics and Midway Manufacturing Company (Manufacturer of Bally Amusement Games), has announced the introduction of a totally new Williams Pinball Controller (WPC) hardware and software system. First launched with *Funhouse*, this system provides a full range of capabilities.

WPC delivers increased state-of-the-art reliability and simplified troubleshooting with:

- Fewer PC boards
- Less connections and cables
- The elimination of AC relays (solenoid bank selection)
- Elimination of PLA chips
- Industry standard audits

Years of development and critical testing have proven that WPC possesses those features and functionality demanded by today's industry. In addition, WPC provides for the future with expansion capabilities to meet the needs of both small and large operators.

WPC: The Inside Story

One of the most noticeable benefits of WPC is the use of fewer boards. The immediate results are easier troubleshooting and the ability to instantly identify which board may be dysfunctional. In addition, interconnecting cables have been reduced. Tracing a wire from the control element to any device on the playfield, cabinet or backbox becomes a much simpler task than ever before.

KEYHOLES

Advanced design techniques now enable boards to be keyhole mounted for easy removal and installation. In dimly lit locations this is of immeasurable help, solving the problem of lost screws or holes that are difficult to line up.

CONNECTORS AND FUSES

WPC features boards with unique connector and fuse designators, thus eliminating any confusion in identification.

The connections that are made to the playfield, cabinet and backbox/insert are done directly from the controlling circuit. The immediate benefit of this design can be seen in field troubleshooting, since there is no longer a need to trace the control path through several boards and connectors.

The use of more ribbon cables has been employed to reduce the bulk of individual wire bundles. This also

allows for vast improvement in following the signal flow of the different boards that make up the system.

EASILY EXPANDABLE

WPC has been designed with an "open architecture" approach to ensure future expansion capabilities, including such near term options as ticket dispenser, serial port, parallel port and German serial port interfaces.

ELIMINATION OF PIAs

WPC has provided a means to remove all PIAs (Peripheral Interface Adaptor) chips. This is a reliability, repair and software reduction decision. Direct controlled latches and buffers are now much easier to program so troubleshooting for all technicians is now as simple as possible.

ALL COILS AT 50v

All coils now operate on the same voltage which has been increased to 50 volts. The advantages are better performance and reliability since the drive transistors don't have to work as hard.

CPU Control

MICROPROCESSOR

The CPU (Central Processing Unit) has now been upgraded to a 68B09E. This faster and more powerful microprocessor allows the software to do more. In fact, the speed of the processors has been doubled and the instruction set is larger and more efficient. This allows the program to control and manage many more events of the playfield than ever before, providing more entertainment value for the player.

CUSTOM CHIP

One of the most noticeable hardware changes to the CPU is the use of a custom chip which eliminates the majority of smaller integrated circuits. The results are greater reliability and the ability to add features without additional cost.

WPC also features a real time clock and day timer, address decode, event sequencing, memory management and much, much more. The custom chip utilizes a battery back-up, along with the CMOS RAM, for protection of any data stored in the RAM.

ROM

WPC provides greatly increased ROM (Read Only Memory) size and although the ROM is now 1Meg, it will soon increase to 2Meg in size. This increased capacity allows the software to accommodate the

greatly expanded diagnostic tools, audit languages and other new features, such as printer output control and enhanced game rules.

RAM

With WPC, the RAM (Random Access Memory) has been increased for better and larger data retention of audits and adjustments. The results are greater efficiency and power to more precisely adjust a game to fit specific locations and better maximize earnings.

EXPANSION PORT

WPC offers impressive expansion capabilities, including the operation of special I/O (input/output) functions. This port is the memory mapped bi-directional communication concept to allow Williams and Bally hardware designers to easily introduce additional new modules.

One example of this is a totally new sound board that delivers faster data transfers and synchronization of sound effects and music to the movement of the ball. Additional options and add-ons will use this same method as ticket dispenser controls.

DISPLAY PORT

For every game's display, a port has been designed that sends data to the display board using a communication concept similar to that in the expansion port. This allows for the reduction of cable requirements for the display to that of a single ribbon cable.

Switches

WPC has enabled the circuits of the switch matrix to be redesigned to accommodate a larger noise immunity. Due to the fact that the switch wires are very close to the coil wires, there is the potential of noise that can affect the operation of the electronics. By increasing the threshold of the required voltage on the switch, WPC eliminates any obtrusive noise on the switches.

A set of direct input switches have been designed to separate coin and diagnostic inputs from the main matrix. This allows the system to monitor these vital switches on a faster and more efficient basis. One of the advantages of this feature is the use of "grounded" switches to improve reliability of switches that are extremely critical to overall game operation. There are also a set of option jumpers for a broader selection of game options.

Power/Driver

LAMPS

Totally redesigned lamp matrix driver circuits now

greatly reduces the power consumed by the sensing resistor for the short circuit protection section. The new configuration greatly reduces the heat and required physical size of the area for this circuit.

COIL DRIVERS

With WPC, all coils operate on 50 volts, which allows for standard off-the-shelf non-selected transistors to be used. In addition, the transistor driving the coil is vastly improved to the degree that current to the coil is reduced, which allows the transistor to operate cooler without any susceptibility to excessive currents that can cause failures.

The "AC" relay that was formerly on the Aux-Driver board has been eliminated and the coil drivers have been grouped into four different categories, including high current, low current, flash lamp and general usage. Each has a slightly different circuit but all use the same basic design.

GENERAL ILLUMINATION CONTROLLERS

In the past, the GI (General Illumination) lamps were on constantly, but, with WPC, that has all changed. The new system now fully controls the GI lamps through software without relays. The result is that connectors and power distribution of the lamps is better controlled to eliminate burnt connectors. In fact, the lamps can be turned on and off as well as dimmed.

In addition, the number of lights have been increased through the use of a five controllable string. This means that features can be added, such as high-lighting a section of the playfield, and, most importantly, a power conservation mode when the game is inactive for a protracted period of time.

POWER SUPPLIES

These circuits generate the voltages anywhere from 50 volt, 20 volt, 18 volt, 12 volt digital, 12 volt power and 5 volt required for the system to operate. Any other voltage requirement is generated off of the power driver board on an as-needed basis. This means that WPC eliminates connectors for higher reliability. The 12 volt is divided into two generators so that switches have a clean and independent supply (12 volt digital) from other components are now mounted on the board to increase reliability via improved pretesting procedures during production.

WPC does operate with more fuses that allow for all secondary transformer windings to be fused before any bridge rectifiers or usage.

continued on next page...

Displays System for WPC

WPC is able to have one of two types of displays as part of the electronic software package designed for a game. There is the 16-digit alpha-numeric display and the other is the all new dot matrix display.

Alpha-Numeric Display**DISPLAY DRIVER**

The display, which has now been separated into a two board method, now offers improved compatibility between both Williams and Bally pinball and more comprehensive repairability.

The power supply for the displays has been relocated to be part of this board. This was done so the very high voltage is not cabled through the cabinet and is generated only where it is needed. The supply voltage has also been lowered to increase reliability.

DISPLAY GLASS

There are two styles of glass carrying boards. One is for the Williams display style and the other is for the Bally display style. The only items on these boards are the connectors and the displays. Since the displays are controlled by two identical ribbon cables, it is easier to troubleshoot if there is a display problem.

Dot Matrix Display**DOT MATRIX CONTROLLER**

WPC is able to support a dot matrix display to enhance visual animated graphics and provide more information than was possible before. Through the use of the dot controller, the WPC system is able to control the graphics of the game displays, while giving an entire new dimension to pinball entertainment.

DOT MATRIX DISPLAY

The dot display is an array of 128 horizontal by 32 vertical dots, giving 4,096 dots of information to the player.

Sound**GENERAL**

One of the major advancements of WPC is software controlled volume control through the diagnostic buttons on the coin door. One main advantage, besides more precise settings, is convenient access for the operator to set volume since it is now on the door rather than inside a dark cabinet. This also helps minimize any noise problems since the low level audio signal doesn't need to be run through the entire cabinet. In addition, all audio is generated from the one board now controlled by one microprocessor with

vastly improved communication to the game microprocessor.

ARCHITECTURE

Due to the inherent power of WPC, memory has increased to 3Meg to provide a greater variety and complexity of sounds, music and speech.

AUDIO PATHS

A better op-amp results in cleaner filters, providing a better digital to analog converter for the best quality sounds, precision balance and no distortion.

AMPLIFIER

A new audio amplifier has been incorporated that has a lower power distortion rating than its predecessor. The sound board is now capable of delivering 115 decibels of power. The use of a crossover network on the speakers now diverts the power to the appropriate speaker in the game for improved fidelity and tonal quality.

AUDIO BOARD POWER

The audio board now carries its own power supply generator except for the logic voltage. With on board power supplies, the voltages are more stable for audio use. Also, this enhanced modularity delivers better overall functionality and simpler troubleshooting.

Software**DIAGNOSTICS**

One of the most critical achievements of WPC is improved diagnostics. Easier to use and menu driven, an operator or technician can toggle through a very straightforward menu. Then, once a given item is reached, it is a simple matter of entering that test. There are also new tests to help the operator or technician get a game back in service as quickly as possible. There is even on line help to find the color of wire, pin number and connector that is of interest.

AUDIT TOTALS

The audits have been expanded to further assist the operator in several ways. Divided into two general categories, the use of "Time Stamps" on the audits is helpful in knowing when data was accessed. And an optional printer interface board means that collections and important game information can be captured on a hard copy for further analysis and improved record keeping.

ADJUSTMENTS

Expanded and easier to use, game adjustments can now be modified to suit the needs and demands of any location with a greater degree of flexibility than ever before.

MicroProse F-15 Strike Eagle Connections

Erik Wittenzellner
Kemp Enterprises, Inc.
South Windsor, Connecticut

SUBJECT

We received one of these units new and plugged it in to try out its play. We liked the impressive self test and down load and the looks of the game once it came up.

PROBLEM

What was a little discouraging was the fact that we could not coin it up! (I hate when that happens.) After a good once over, I found that the reason behind the problem lies at the connection at the MPU Board, which has no locking mechanism to secure the connector to the board.

To make matters worse, they put a heavy ferrite tube over the harness close to the connection. With gravity and game moving, (the facts of this business), you soon have a loose connector to deal with.

A few well placed wire ties are in order for this area, and also under the control panel which is a rats nest of wires and connectors. I found one wire pulled from its molex connector, due to a bad crimp.

I hope that this is an isolated case because of the amount of interconnections in this game is unbelievable.

NOTICE

One last point is the control panel latches. Don't be fooled, like I was, into thinking that the latches are the only thing which holds the panel down. There is also a bolt through the side of the game below the throttle which is hard to see if you are not accustomed to the hybrid securing techniques of this game. Be careful, be patient and good luck.

The Original Lane Retainer

"Keeps The Balls Where They Belong"

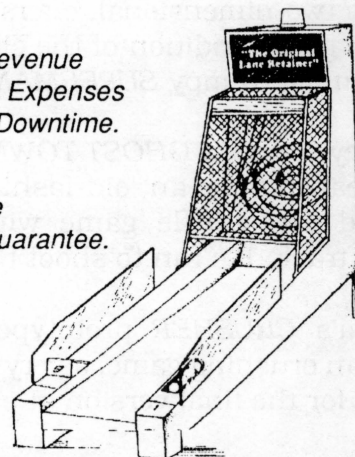
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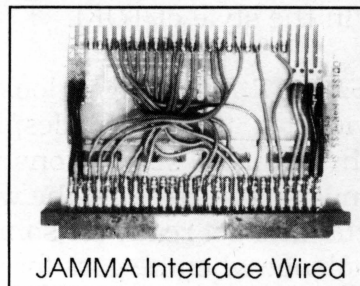
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So, What'd Ya Like At The ACME Show?

Bill Johnston
Johnston Video
Buffalo, New York

Atari's *BATMAN* (horizontal, joystick + 2) although two-dimensional, offers a good depth of play. A good rendition of the character and his cape, unlike wimpy *SUPERMAN* and his kick.

Bromley/Bundra *GHOST TOWN* offers redemption features in an old-fashioned graveyard themed target/rifle game with an excellent sound track. It's fun to shoot this one.

Bundra's *CRUSHER* prototypes a countertop beer can crushing game, a very attractive piece. Watch for the final version at a popular price.

Data East pin *CHECKPOINT* plays great, and with the unmatched-by-the-coition flipper power they run, expect a hit. When asked if they planned to sell a kit to fit Data East flipper assemblies into Williams/Midway's *FUNHOUSE* pin, the Data East Pinball Techs that Darl Davidson referred us to said "No, we don't want to smash through Rudy's head!"

Data East's *CAVEMAN NINJA* has good Las Vegas gameroom reports from Leon Cauchois at Palisades Amusements, with its cute action carrying on in the style of *TOKI*.

Capcom's *STREET FIGHTER II* looks like the must-buy video of the show, despite its two players each requiring six buttons which will lengthen conversion time. Pick the werewolf for your character and get ready for some powerful on-screen violence when he goes for your fellow player's jugular!

Gene Sieben at MH Associates lists *STREET FIGHTER II* and Fabtek's *RAIDEN* as two titles for every street route.

Happ Controls showed off their new prototype of an over-under door with a stackerless bill acceptor and a quarter mech on the top door. The bucks just dump nicely into the cashbox below,

The American Coin Machine Expo was held March 22 - 24 at the Sands Expo Center in Las Vegas.

with an easy capacity of \$1000, according to Frank Happ.

Kaneko's Marty Glazman is smiling again at this show. Last fall's AMOA show launched a hit with *GALS PANIC*, a strip *QIX*. Now, exactly ten years after *SPACE PANIC* by Universal made its dedicated debut, Kaneko has again recycled a winning game concept with *THE BERLIN WALL* (2-player interactive, joystick + 3 buttons each). As in *SPACE PANIC*, it's dig the hole, attract the enemy to fall into it, and smack him in the head, or jump on him to kill him and win points.

Konami's dedicated 4-player *SIMPSONS*: Although early test reports are strong and fans of the television show who played the game liked it, there's something to be cautious about here. The game itself is nothing more than a weak representation of a 4-player version of *DYNAMITE DUX* by Sega. Admittedly, the *SIMPSONS* is indeed a low-resolution cartoon, but speaking as a non-fan of the TV show, this game is weak in graphics and looks like it belongs on a smaller monitor. For arcades it's probably a must, but for the street... my advice is wait for a 2-player kit version and play it on a 19-inch monitor. For Fans only?

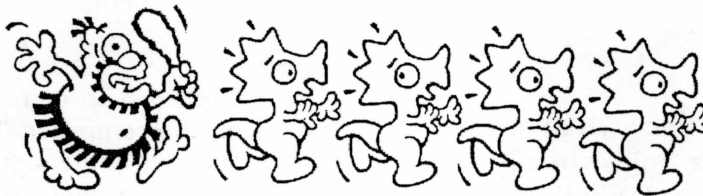
Bill Foster's newest *K-COIN SCALES* boast a built-in printer in the same housing, and earlier used models can be rebuilt to include this feature.

Tom Ordway at Lynde-Ordway boasts that all new updated *DOWNEY-JOHNSON* coin counter parts can still fit all previous models. He's also considering shedding some weight with unbreakable plastic housing parts in the future.

Strata's *PEGGLE* wins a real creativity pat-on-the-back for the Incredible Technologies game designers. It's a JAMMA vertical, and plays with a trackwheel like *REVENGE OF DOH*. Just keep

Peggle or Peggy (Ms. Peggle?) bouncing off the pegs as you rotate them. Strong female and younger player appeal, this looks like a redemption winner.

Sega's 3-dimensional laser player hologram projector gives you startling characters that could fit into your hand, but when you reach for them they're not there. Although *THE TIME TRAVELERS* shifts as poorly and slowly between action scenes as *DRAGON'S LAIR*, the visual effect of the game will command premium pricing. Make sure you put a bill validator on this one for sure.



While stepping forward with holograms, the graphics on *RADMOBILE* took a step backwards. And *OUT RUN* is more fun.

SNK: I always backed off whenever it came to systems, especially when they are also geared to the home market, but SNK has finally got my attention with two strong cartridges for their NEO•GEO system. *SENGOKU* gives a nice kick in the cashbox, and *BURNING FIGHT* is a great street-fighting game in the style of *FINAL FIGHT*.

Taito's Jim Miskell points out some versatility with his *GROWL* kit. It can switch into a two player cabinet or two two-player cabinets or a four-player cabinet.

Williams/Midway was an entertaining booth: *SLUGFEST* updates the old theme of *PENNANT FEVER*, a baseball bat in a pinball cabinet game. Not only does it add features like stealing bases, this unit has a baseball card dispenser on it so you can win cards! Bar game or kid game, and probably both.

Evan Wessel of Mercury Amusement Company said it's time to put pinball back on my route with *FUN HOUSE*. It was the most fun of all pinballs at the show, shooting balls at Rudy's head, and plenty of strategy shots, underground

balls, and multi-ball.

STRIKE FORCE updates the theme of *DEFENDER* (has it really been ten years?) but this time it's a horizontal 2-player interactive kit, with joystick + 4 buttons for each player. Yes, even the miniature space men are here to save again.

And finally, my true favorite of the show is from George Petro and Jack Haeger, with sounds by Chris Granner. *TROG* is finally born as the ulti-

mate versatility kit: It can be installed into a 1 or 2 or 3 or 4-joystick cabinet! Now there's some dipswitching!

This should be a consideration for the AMOA Standardization Committee as a standard feature for all game pcb's. *TROG* combines some fresh graphics like clay animation with cute dinosaur play, and now your dinosaur can punch the cavemen. Eat a pineapple energizer and you mutate into a tyrannosaurus rex and eat the cavemen. First dinosaur to collect all the matching eggs without being eaten by the caveman, falling over the cliff, or getting stuck in a muck pit, wins the round. I love this final version of *TROG*, and will be watching the charts for it.

Sharon and I must thank Mr. and Mrs. Leon Cauchois of Palisades Amusements of Las Vegas for their unlimited hospitality during our visit. We also enjoyed getting together with Mr. (and his new Mrs.!) Brian Sniegocki of B & D of Toledo and the *STAR★TECH Journal* BBS(bulletin board system) Users Group (SUG). Brian suggests his suite at the Rio for the next BBS Get-Together at the September 12-14 AMOA '91 (Las Vegas) Show.



Williams Funhouse Plunger Switch

Dave Verreault
Golden Mile Family Amusements
Ontario, Canada

SUBJECT

One of our employees has discovered a problem with *Funhouse* that can cost you earnings by increasing the length of play by giving extra balls! That's the bad news, the good news is that the problem is easily fixed.

PROBLEM

The problem is with the outhole switch and the plungers. It seems if a player holds the plunger in all the way before shooting the ball onto the playfield, he can get any locked balls to come out of the locks. This occurs while he holds the game ball with the plunger.

What is happening is that the plunger holds the ball far enough forward that it comes off the switch and the game starts to look for a trapped ball. This takes a few seconds(30) and then it clears all the locked balls and the player plays those balls while he still has the game ball in the plunger lane.

SOLUTION

The fix is to adjust the switch further up so that it will always make contact with the outhole lane switch, no matter how far they push the plunger in, this works with the step ramp plunger also.

We started seeing scores in the 20 million range to as high as 40 million until we found this slight problem. It seems to originate from the factory, as an over-looked switch adjustment.

So if your scores are going up, check this out, I have seen ball times as high as 30 minutes, this can kill a game. Even one as great as this pin.

Phone & Fax

See page 21 for updated manufacturer customer service phone & fax numbers.

Rowe CD-100 & CD-51 Random Play

Shawn Puckett
Talley Adjustments
Clinton, Missouri

PROBLEM

Rowe *CD-100* and *CD-51*, randomly picking up wrong disc or playing wrong songs. We started buying CD players last fall. So far we've bought 11 Rowe *CD-100*'s and 3 Rowe *CD-51*'s. All but 2 of them have had the same problem.

SYMPTOM

Error 05-05 keeps coming up when we check for errors on the computer. This error means that both the index and home signals are changing, but the mechanism is unable to determine the magazine position. The service manual shows three possible answers:

1. A defective optical switch.
2. A loose connection wire/terminal at P11 on the mechanism controller.
3. A defective mechanism control.

All three assume that the optical switch is adjusted correctly. But all of our units with this error were incorrectly adjusted. When I called Rowe Tech Support they said that they are set at the factory, but shipping and handling might put them out of adjustment. So it's a good idea to check your units out after a move. (This problem will not show up on the computer all the time).

PROCEDURE

To check if your optics are correct:

1. Push in the dentent plunger and rotate the magazine to position 99.
2. With the dentent plunger engaged, rotate the magazine in both directions as far as you can by hand (taking up the gear backlash in both directions). The INDEX LED will remain OFF and the HOME LED will remain ON when properly adjusted (sometimes HOME LED will go OFF with backlash).
3. Push in the dentent plunger and rotate the magazine to position 06, 56, 07 and 57. Repeat step 2 at each position, except both INDEX and HOME LED's will remain OFF when properly adjusted.

NOTE

If it is incorrectly set, the Rowe Service Manual shows you the procedure to adjust the optical switch.

=====TESTER for BALLY & STERN FLIPPER GAMES=====

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Bally & Stern Pinball Tester Review

James Beck

Greater Southern Distributing
Atlanta, Georgia

Well, I've said it at every STAR★TECH Journal seminar I've done and I'll say it again, "The availability of reasonably priced test equipment for use in this industry is poor". Other than the standard stuff available to every type of electronic service personnel, the *really* needed stuff is too expensive. The unfortunate fact that this is such a vertical column industry is the main reason. Since a test jig manufacturer can't expect to sell too many of the item, if it is industry specific the money has to be made on a per unit basis.

STAR★TJ Test

I had the chance to work with a unit offered by Two-Bit Score of Austin, Texas that tests the old Bally and Stern pinball systems. Those, you'll remember, are the ones with the 32 pin expansion connector at the top edge. I wouldn't say it is an inexpensive unit at \$300, but if you operate a lot of the older units it might just come in handy.

QUALITY CHECK

When I received the unit, I gave it a good once over to check out the quality of the work. The whole system consists of two good quality pcb's and two cables to make the needed connections to the unit under test. The system ROM is socketed so you can make archived backups in case you don't follow the directions and check

out the supply voltage, and it fries the unit. The system ROM and two support IC's are located on the main board.

The second board consists of 40 push button switches that are used to test the switch matrix system. The only gripe I have with the boards is that they are bare boards, that is, no protection

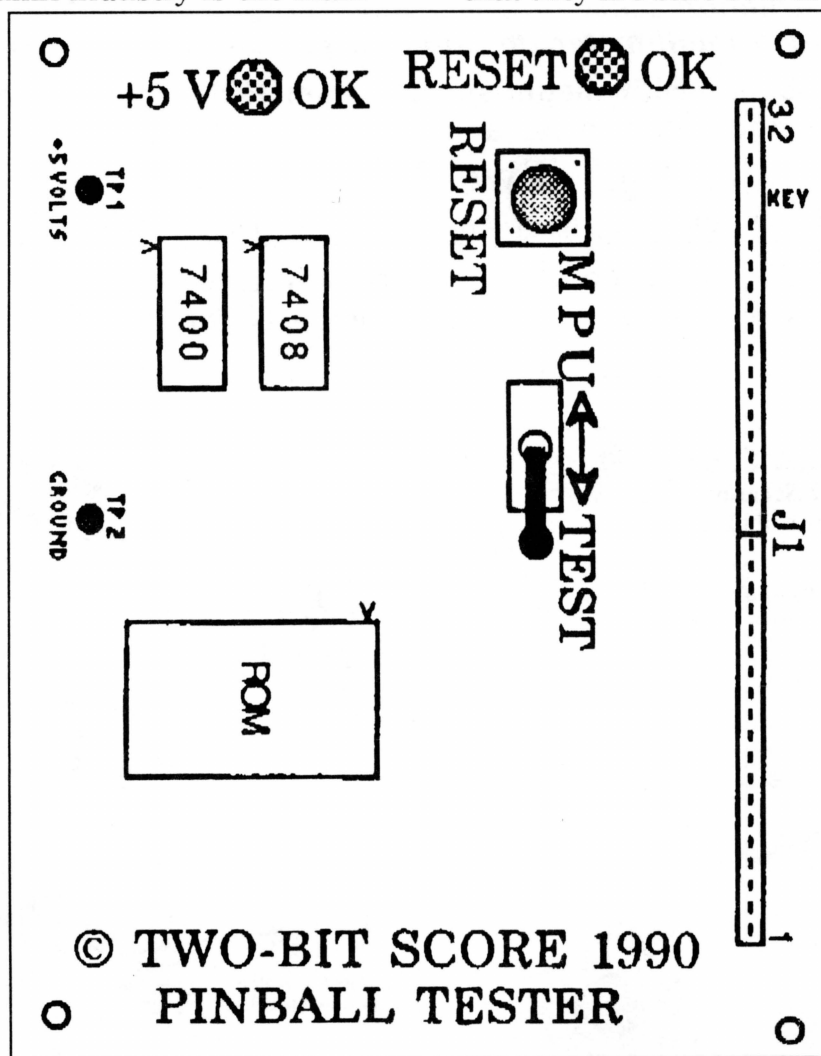
from tools and other things that might come into contact with them if they are carried around by a field service tech. I know I expect my test equipment to be at least a little more "bullet proof" than these might be, but if you are at least a little careful with them, the odd soldering iron collision and wire stripper rubbing against the PCB for 100 miles of bumpy travel might not be a fatal problem.

DOCUMENTATION

The manual is fairly comprehensive and should lead a moderately trained tech to a valid conclusion on what has gone awry with most sys-

tem problems. The layout of the manual is also pretty good. There are no bumps in the continuity and everything progresses in a nice linear fashion. The in depth troubleshooting of some of the less common problems isn't covered, but this is not considered too major a deal.

continued on page 16...



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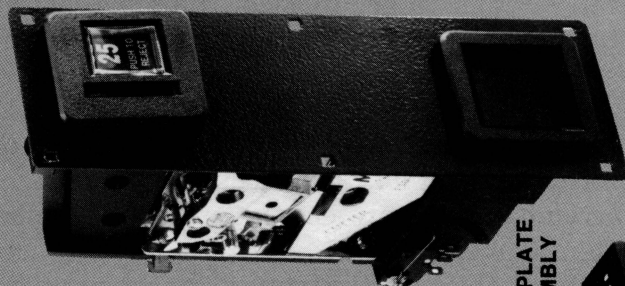
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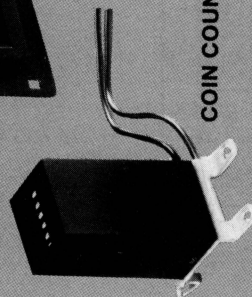
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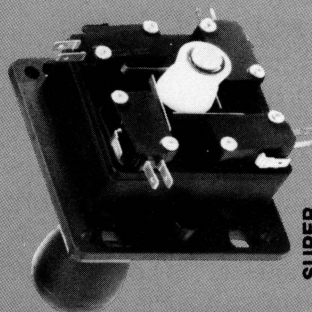
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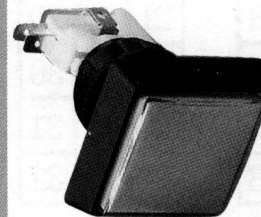
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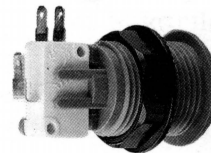
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CAUTIONS

A couple of practices are put forth that I don't agree with as a general rule, but may not be so bad when working on a low performance, low clock speed, low parts count board such as these older pin boards. First is the old "If it was working and now it's not working it must be a semiconductor failure". There is little mention of passive components that may be at fault.

The other is that when replacing a component you might as well put in a socket now, because "if it failed once, it will probably do it again". I will agree that on these boards contact capacitance and inter-lead capacitance isn't too much of a problem, but *don't* extend that practice onto other systems, especially clock circuits and any other circuit where a timing problem might occur.

Test number two is the lamp test. Needless to say this test jogs the lamp driver board. It starts off by flashing all of the feature lamps, but it will also allow you to test individual lamp drivers.

The next test is the solenoid test. It lets you enter the driver transistor number on the keypad and then pulses that transistor. A quick and easy way to jog just the defective circuit so you can get to testing straight away.

There are also sound tests for the Bally boards that don't require any additional hardware. But to test the Stern sound board, you'll need a working Bally AS-2518-35 CPU board to put the test system ROM into. The Stern board uses the same connector the test system uses.

CONCLUSIONS

To wrap it up, I would like to mention that the greatest thing this tester does is bypass *all* of the onboard program so that it will work on any Bally "2518" or Stern MPU-X00 regardless of the jumpering. Giving you a chance to bypass all of that circuitry instantly is worth it to me.

The actual tests themselves are a little better than the built in stuff, but not drastically so. The combination of the manual and the jig is more than enough to get most of the old Bally and Stern problems worked out by just about any level technician.

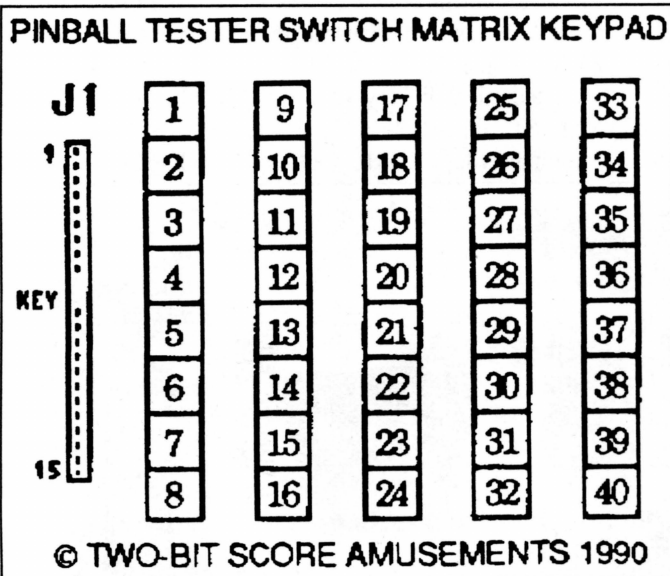
I personally would like to see the addition of a protective cover for the boards or at least a small carrying case to protect the small components when traveling, and a little more in-depth troubleshooting in the manual for the route man or beginning tech. As for the \$300 price tag, that's up to you.

Ed. Note

The manufacturer supplied STAR★TECH Journal with a prototype unit to be evaluated. The production units now come complete with a vacuum-formed hinged case with cover to enclose the test system entirely.

FOR MORE INFO

Two-Bit Score, 11600 Manchaca Road, Austin, TX.
Phone: 512/282-9369.

**TESTING**

If the board powers up OK or you get it up and running after a repair, then the test system allows you to fully jog the I/O of the board in search of other problems.

The first test is the display test. This test lets you use the included switch matrix keypad to enter which digit and which number you want to test individually or you can do a full count of them all. Real nice for testing individual digit or segment drivers.

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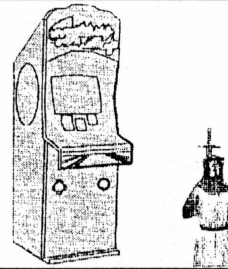
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Rowe's OBA-2 Bill Transport Repair & Maintenance (Part 1)

Rowe's OBA-2 Bill Transport can be found in most of Rowe's jukeboxes, old and new. Rowe's CD-100 series jukeboxes all have the OBA-2 Bill Transport in them. Everything from Video Poker Terminals to Vending Machines use the Rowe OBA-2 Bill Transports.

In light of their popularity, I decided to give you some information on maintaining and repairing the OBA-2 Bill Transport. This issue will deal with changing the Upper Belts, and cleaning of the optics. Part II (next issue) will deal with troubleshooting and repair.

UPPER BELTS

The first thing we'll talk about is changing the OBA-2 Bill Transport's (BT from now on) Upper Belts. This is probably the most common problem. Learning to change your own belts will save you down time and money. The belts run around \$2.50 or \$3.00 each, maybe more with some sources.

Replacing the belts yourself will also give you a better understanding of how the BT works and how to disassemble the BT for other repairs. The BT may look rather confusing, but after you do a couple, disassembling and cleaning should take about 15 minutes. This can be done on location if you have a place to work (a cocktail table will do).

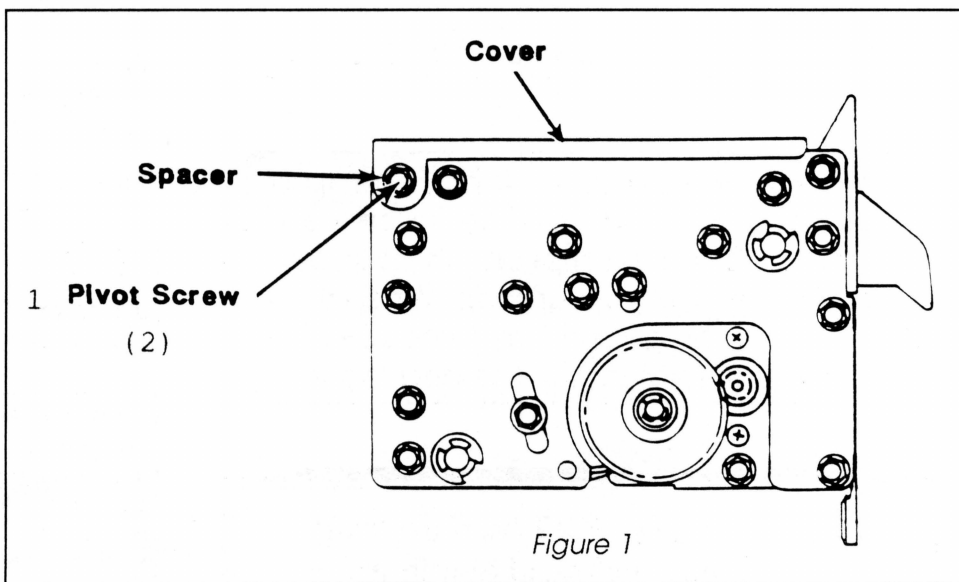
DISASSEMBLY

The first thing you need is a work area that's clean of debris. Then get these tools out:

- 1) a 1/4" nut driver
- 2) a 11/32" nut driver
- 3) isopropyl alcohol (90%) and swabs
- 4) small Phillips screw driver

Set the BT in front of you with the bill input away from you. As you disassemble the BT, arrange the screws and shafts in the order you take them off. This way if you get lost, you can retrace your steps. Follow these steps as you refer to Figures 1 & 2:

- a) Remove Pivot Screws with Spacers (Figure 1, step 1) and remove Top Cover.
- b) Back out Casting Screws until Wire Spring can be removed (Figure 2, steps 2 & 3).
- c) Remove Nut (11/32"), then Central Roller Spring.



- Remove Wire Retaining Clip (Figure 2, steps 4, 5, & 6).
- d) Remove Input Shaft with Upper Belts attached, but be careful not to drop the bushings on either end of the shaft. Remove belts from Input Shaft (Figure 2, steps 7 & 8).
- e) Remove the four screws to the Magnetic Head Assembly, but don't remove assembly (Figure 2, step 9).
- f) Remove the Rear Roller Shaft Screws and remove Rear Roller Shaft. Slide belts off Magnetic Head Assembly and move assembly to the left out of your way (Figure 2, step 10).

denotes step

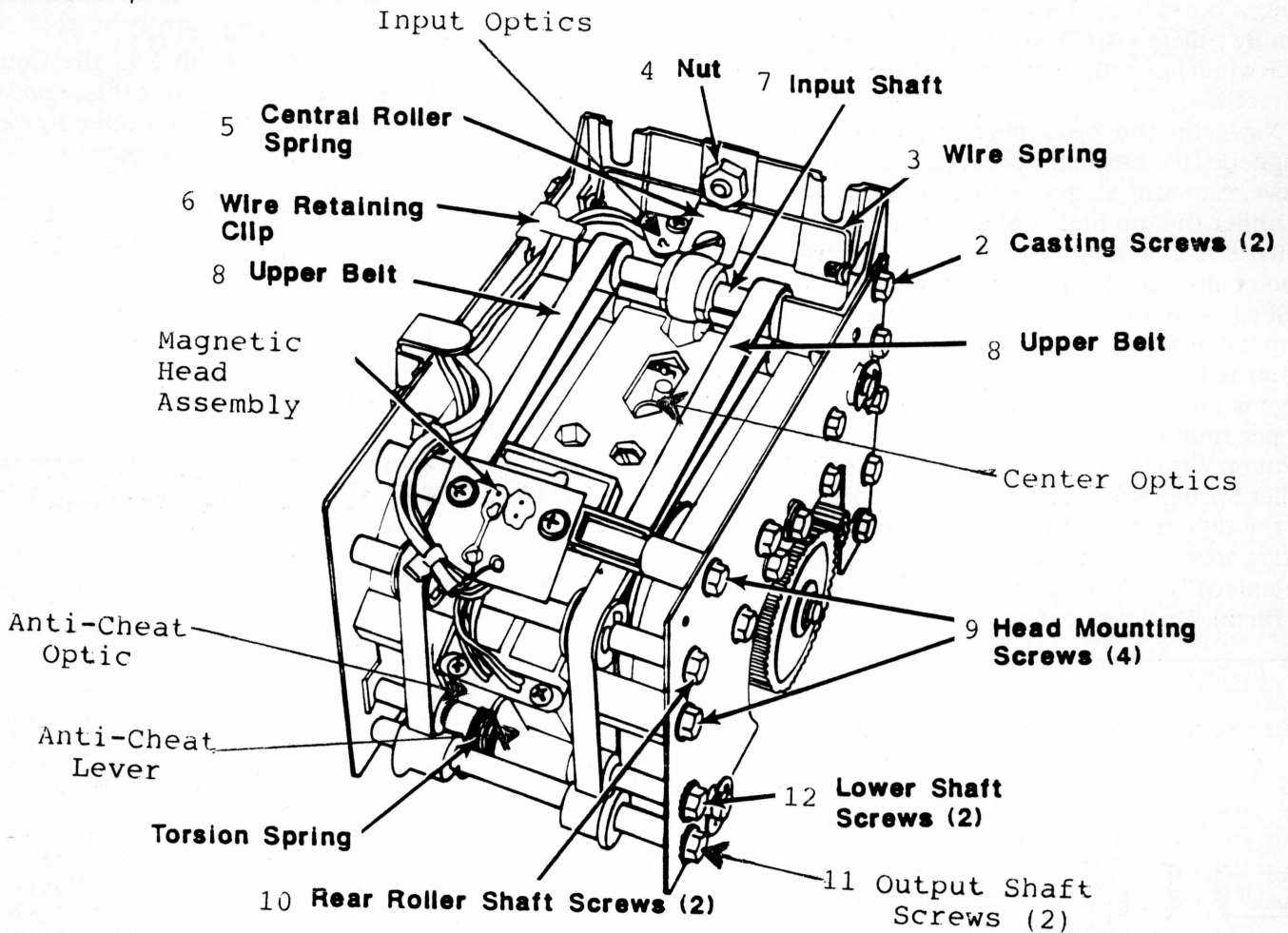


Figure 2

g) Remove Output Shaft Screws and Output Shaft (Figure 2, step 11).

h) Remove Lower Shaft Screws and Lower Shaft Anti-Cheat Assembly with Upper Belts attached. Push down to release shaft from BT (Figure 2, step 12).

CLEANING

While you have the BT disassembled, clean the optics with isopropyl alcohol and a swab. First remove the Input Optic by removing the Phillips screw, then swab both lenses with alcohol and remount optic (refer to figure 2 for locations of optics).

Now clean the Center two optics with alcohol. Turn Magnetic Head Assembly over and swab mag head with alcohol removing all dirt and gum. Now swab the Anti-Cheat Optic, located on the Magnetic Head Assembly, with alcohol. If you cannot get the swab in the slot between the Anti-Cheat Optic, then use tuner cleaner spray to clean this area (use the one that's safe on plastics).

REASSEMBLY

A few things to keep in mind when reassembling the BT:

- 1) All the shafts are shorter on one side than the other. Looking at the BT from the back, the shaft's short side goes to the left.
- 2) The Upper Belts should be kept in line with the Lower Belts as much as possible. This will avoid pinching the Upper Belts under the shafts while reassembling the BT.
- 3) When remounting the Magnetic Head Assembly, firmly push the assembly down on the "V" shaped mounts and put the top two screws in first. This will hold the alignment of the Magnetic Head Assembly.

PROCEDURE

- a) Slip new Upper Belts over Lower Shaft/Anti-Cheat Assembly and remount Lower Shaft/Anti-Cheat Assembly with Anti-Cheat Lever up.
- b) Remount Output Shaft, being sure to hook the Torsion Spring (Figure 3, number 5) to the Lower

Shaft/Anti-Cheat Assembly. Make sure to keep roller flanges outside of the Lower Shaft/Anti-Cheat Assembly rollers. The Anti-Cheat Lever should spring back when pushed, if the Torsion Spring is hooked up correctly.

c) Now slip the belts over the lower half of the Magnetic Head Assembly and in keeping with note 3 above, remount Magnetic Head Assembly. The belts go under the top half of Magnetic Head Assembly.

d) Remount Rear Roller Shaft, being careful not to pinch belts, and keep the belts straight.

e) Slip the belts over the Input Shaft, be careful not to drop the bushings. At this point, make sure the belts are straight (note 2 above) and move freely. Rotate the large white gear on the side of the BT, to check for proper rotation of the Upper Belts.

f) Put on Wire Retaining Clip, then put on the Central Roller Spring, Nut and tighten. Put Wire Spring back on the tighten Casting Screws (be sure not to pinch optic wires with Wire Spring).

g) Replace Top Cover with Pivot Screws (with spacers on them). Hook up and test BT.

Lower Shaft/Anti-Cheat Ass.

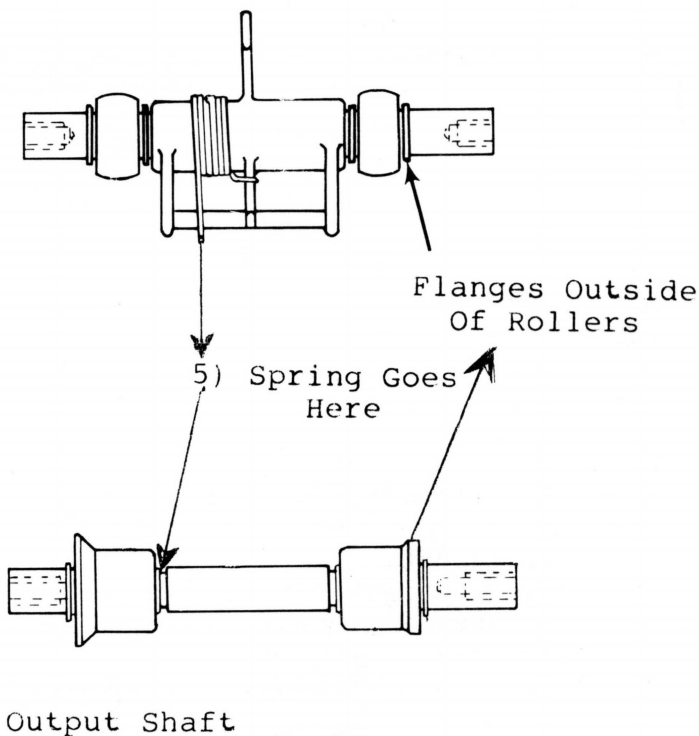


Figure 3

NEXT MONTH

I'll talk about some common problems and how to identify them, along with proven repair procedures.

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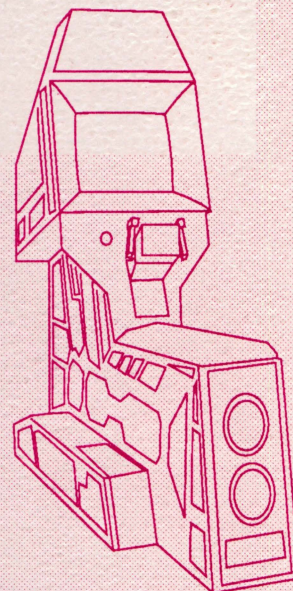
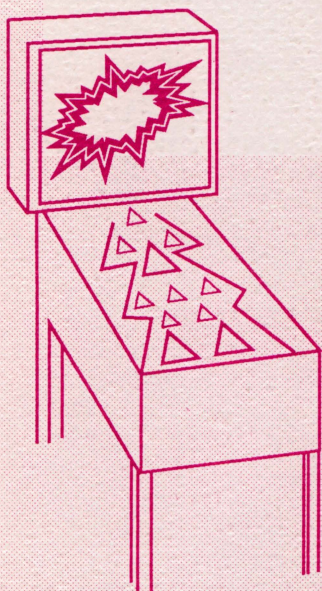
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